Righi, Bologna; Sir Ernest Rutherford, Cambridge; and Professor E. Van Aubel, Ghent.

UNIVERSITY AND EDUCATIONAL NEWS

YALE UNIVERSITY has received from an unnamed graduate a gift of $3,000,000 to the general endowment of the university, contingent upon additional gifts of $2,000,000 by next January, exclusive of those through the alumni university fund. The gift is made to meet increased faculty salaries.

CORNELL UNIVERSITY has received a gift of $500,000 from Mr. August Heckscher, of New York City, for the endowment of research. The income of the fund created by Mr. Heckscher's gift will be used to maintain research professorships and to provide facilities for scientific work.

PROFESSOR FRANKLIN MOON, who has held the chair of forest engineering since 1912, has been elected dean of the New York State College of Forestry at Syracuse.

DR. EDWARD BARTOW, chief of the Illinois State Water Survey Division, has been elected head of the department of chemistry of the Iowa State University.

DR. H. E. WELLS, formerly professor of chemistry at Washington and Jefferson College, has been appointed professor of chemistry at Smith College.

PROFESSOR HORACE GUNTHORP, of the department of zoology and physiology at Washburn College, has accepted an assistant professorship of zoology in the University of Washington, at Seattle.

DR. H. M. DAWSON has been selected to be the occupant of a newly established chair of physical chemistry at the University of Leeds.

DISCUSSION AND CORRESPONDENCE

ORTHOGENESIS AMONG FISHES

IN tracing successions of fishes, extinct and recent, we observe the outlines of a law or generalization, still vaguely understood, which seems to be in line with Eimer's conception of orthogenesis. This is defined as the doctrine that the phylogenetic evolution of organisms takes place systematically in a few definite directions, as contrasted with irregular divergence in many directions.

The facts in brief are these: In certain groups some particular structure will acquire a high degree of development and specialization; this being pursued along what might seem to be a definite determinative line; after which, the structure, being over-developed, undergoes again progressive degeneration, sometimes being altogether lost.

Two series of fishes may illustrate that point: the rock fishes (*Scorpœnidæ*), in their most primitive forms are very much like the different types of bass, the chief difference lying in the presence of a peculiar backward extension of the bone under the eye, forming what is called the suborbital stay, and the fact that the skull has spines on its upper surface. We have the elaboration of spines on the head, the elaboration of scales, forming ultimately a series of bony plates, the extension over the head of a coat-of-mail, the elevation of fins, and other modifications. These gradually fading away through the different categories of sculpins (*Cottidæ*), until we come to the sea-snails (*Liparidæ*). These still retain the suborbital stay, but have lost all the hitherto specialized qualities: there are no scales, the body is covered with thin movable skin; there are no spines anywhere on the head or fins, and the fins themselves are very small in size, largly enveloped in the soft flaccid skin.

Quite as remarkable is the process of evolution and transformation of the butterfly fishes (*Chætodontidæ*). Beginning with forms like *Ephippus,* not very different from ordinary bass-like species, these fishes become specialized in very high fins, the reduction of the size of the gill opening and the development of brush-like teeth of the mouth. Passing on further we see the tail provided with bony structures, sometimes with a brush of spines like porcupine quills, sometimes with a sharp cutting lance in a sheath on either side. The scales grow smaller and rougher, the fins being however reduced in height and in

number of spines. Later the scales grow still smaller, becoming like shagreen; bony plates appear, while the spinous dorsal, ventral fins and the gill openings undergo reductions. Later the spinous dorsal and the ventrals disappear altogether, the teeth coalesce into two in each jaw and finally into one in each jaw; this series finding its extreme in the head-fish (*Mola*), in which the body is deeper than long and seems to be simply a great head with a fin behind it.

Turning in another direction, the spinous fins disappearing, the body is covered with bony plates, and these finally interlock with each other, forming a complete bony box absolutely immovable. Species thus provided are known as trunk-fishes (*Ostracion*), and in these the bony plates sometimes extend themselves into spines, especially on the head, which thus acquires a fantastic appearance.

Similar changes are found in other groups, the general rule being extreme specialization of a particular organ, producing its expansion and high development, ultimately followed by its reduction and final disappearance. In each group the species most normally formed are the earliest to appear in geological history, while primitive forms often linger with the others to the present time, most of these groups having their origin in the Eocene. Thus many of these early types, even the earliest, remain to the present day, showing apparently that non-specialization, ultra-specialization and loss of structure are all of secondary importance in the struggle for existence, and that they are conditioned on something else, a law not yet understood.

David Starr Jordan
Stanford University

Einstein's Theory and Shift of Spectrum Lines

According to Einstein's theory, as I understand it, any time piece, as *e. g.*, a vibrating atom, automatically goes slow if placed in a strong field of gravitation; also the effect of a gravitational field is not to be distinguished from inertia effects in any accelerated motion. A particular illustration is that of a clock moving in a circle. It would seem that there should not be much difference between the effects of an acceleration produced thus and that produced by magnetic or electric fields.

In the Stark effect, where the radiation from atoms in a strong electrical field is studied, it is probable that some of the radiating atoms are in a charged state. If one computes the acceleration of a hydrogen molecule with one unit of charge in a field of 20,000 volts per cm., without considering the dragging effect of other molecular fields, one finds it to be of the order of 10^{16} cm. per sec. per sec., much greater than the value of g at the sun, so that if the atom could radiate in this state very large displacements in the spectrum lines should be expected, amounting to the appearence of new lines. Even if the atom as a whole is neutral, yet because of the nonhomogeneity of the field and the distance between the positive and negative constituents of the atom, considerable accelerations are to be expected which will be larger according as an electron is farther removed from the central nucleus. It is interesting then to recall that Stark found in several instances a displacement of his central image towards the red end of the spectrum, and found the components unsymmetrically placed, also that in a number of cases entirely new lines have been found.

If the preceding point of view is correct, then in any case of luminosity in a gas, since during "collisions" the atoms are evidently in strong fields of force, a slight displacement of the center of gravity of a line towards the red would appear, and this would increase with the pressure as in the common pressure effect. The explanation of the pressure shift as due to the action of adjacent molecular fields has been given, and according to Einstein's theory that would bring it into accord with the general relativity views of time. The difficulty of distinguishing between the pressure effect and the one predicted by Einstein in the sun has been noted. Is it not possible that this lies in the nature of things, the difference being that while all matter is subject in the same degree to gravitation, the